

**RELATED APPLICATION**

This is a division of U.S. Application Serial No. 09/828,911 filed April 10, 2001, which issued a U.S. Patent No. 6,651,589 B2 on November 25, 2003.

**MARKED UP  
COPY**

**A FEED METERING DEVICE**

**FIELD OF THE INVENTION**

for distributing fodder or drink or both

The present invention relates to a feed metering device, according to the preamble of claim 1, such a feed unit may be constituted by a manger or feeding trough, or both, a unit provided with a nipple valve, a valve may be provided for calves.

**BACKGROUND OF THE INVENTION**

Such a feed metering device is known from European patent application EP-A-0610171. By means of a control unit the closing means of this known feed metering device is actively kept in the position in which it closes the manger or feeding trough.

**SUMMARY OF THE INVENTION**

It is one of the objectives of the present invention to provide an alternative feed metering device for distributing fodder or both, or drink, in metered portions to an animal, which device, on the one hand, deters in a constructively simple, efficient and cheap manner animals that are not eligible for being fed from putting their heads into the feed unit, and, on the other hand, offers additional advantages.

For that purpose, in accordance with the invention, a feed metering device of the above described type is characterized by the measures according to the characterizing part of claim 1, by a roll for closing the closing means which roll is driven by a motor.

The feed metering device preferably includes an animal identification device, the roll being controlled with the aid of data from the animal identification device.

In an embodiment of a feed metering device according to the invention, there is obtained a compact construction when the roll is disposed in the vicinity below the entrance opening. Preferably there is disposed a housing in the vicinity below the entrance opening, in which housing the roll is mounted at such location

The closing means may be formed by a separate component, but is preferably constituted by the feed unit itself, which is designed as a movable one. As a result thereof the number of components is limited and the feed metering device can be manufactured economically, cheaply, or both.

In order to prevent fodder and/or drink from falling from the feed unit in certain positions of the feed unit, the

latter, or both, comprising a wall portion for catching remaining fodder and/or drink. Said wall portion can also act as a feed guide means for fodder and/or drink, that is supplied by the feed supplying device to the feed unit.

A ~~stable~~ <sup>enduring and firm</sup> construction is obtained when the feed unit bears on the housing via the roll.

The motor is preferably included in ~~the~~ such housing, so that a compact construction is obtained. The housing also serves for protecting ~~the~~ the motor against contamination, damage and the like.

> A quick and accurate identification of animals is obtained when the animal identification device is included in the housing, the animal identification device then also being guarded against contamination, damage and the like.

15 The feed metering device preferably comprises further deterring means for deterring an animal, which include a loudspeaker for producing an animal-frightening sound. Certain animals have appeared to be highly sensitive to certain sounds, so that a loudspeaker is ~~very~~ appropriate for deterring such 20 animals. Moreover, such a loudspeaker may be used for producing calming or stimulating sounds when an animal uses the feed metering device correctly.

25 Alternatively or additionally, the further deterring means may include means for generating an animal-frightening light. In particular when a plurality of feed metering devices are disposed side by side, the use of <sup>a</sup> frightening light is desired, as this light can be directed in such a manner that its effect is limited to one particular feed metering device.

30 The further deterring means may include a voltage emitting device for emitting an animal-frightening electric voltage. Sound and light have proved to be effective for deterring unwanted animals, but have the disadvantage of being observable sometimes, at a greater distance, from the relevant feed metering device. Animals that undesirably visit a feed 35 metering device often make contact with the feed metering device, usually with their noses. By linking with a voltage emitting device precisely those components of the feed metering

~~device that are regularly touched by the animal~~, it is possible to deter ~~a particular~~ animal ~~very~~ locally. Alternatively, a forced air flow may be used for deterring the animal.

A preferred embodiment of a feed metering device according to the invention is characterized in that the feed metering device is provided with means for weighing the fodder and/or drink, present in the feed unit, which means move the feed unit in a pivoting, respectively rotating manner. Thus it is possible to determine how much fodder and/or drink, is consumed by a particular animal. On the basis thereof the amount of fodder and/or drink, consumed by an animal can be determined over the course of time and accordingly the health condition of an animal can be deduced; for, when an animal unexpectedly takes a smaller amount of fodder and/or drink, this may be a sign that the animal is ill. Moreover, it is undesirable that, when an animal leaves a certain amount of fodder and/or drink, the amount of fodder and/or drink for the next animal is supplied to at the feed unit without these remnants being taken into account. The means for weighing the fodder and/or drink present in the feed unit are preferably linked with the feed supplying device for supplying an amount of fodder and/or drink to the feed unit with the aid of data both from the animal identification device and the weighing means.

The means for weighing the fodder and/or drink present, in the feed unit may comprise a feed unit which is pivotable about a hinge pin, the degree of pivotability being determined by the weight of the fodder and/or drink present in the feed unit, and a device for determining the degree of pivotability of the feed unit and for deducing, from the degree as determined, the weight of the fodder and/or drink present in the feed unit. The degree of pivotability of the feed unit depends on the amount of fodder and/or drink in the feed unit. The more fodder and/or drink, the larger the degree of pivotability. The exact correlation between the degree of pivotability and the amount of fodder and/or drink, can previously have been determined by means of simple calibration tests.

A compact construction of the feed metering device is obtained when the device for determining the degree of pivotability of the feed unit and for deducing, from the degree as determined, the weight of the amount of fodder and/or drink, present in the feed unit, is integrated in the animal identification device.

When the device for determining the degree of pivotability of the feed unit and for deducing, from the degree as determined, the weight of the amount of fodder and/or drink, or both, present in the feed unit comprises a measuring roll which is in contact with the feed unit, it is possible to determine from the degree of rotation of the roll, the degree of pivotability and thus the amount of fodder and/or drink, in the feed unit.

Alternatively or additionally, the device for determining the degree of pivotability of the feed unit and for deducing, from the degree as determined, the weight of the amount of fodder and/or drink, present in the feed unit, may comprise a load sensor, the feed unit bearing on the load sensor. The load sensor is preferably included in the animal identification device.

In order to be able to measure even a small difference in weight, in a preferred embodiment of a feed metering device according to the invention, the hinge pin, and the load sensor respectively the measuring roll, are located at a small distance from each other.

In order to prevent for example the load sensor from being damaged in the undesired event of a defect, there is provided a safety supporting bracket for the feed unit.

A preferred embodiment of a feed metering device according to the invention is characterized in that the means for weighing the fodder and/or drink, present in the feed unit comprise a movable feed unit, a motor for moving the feed unit, a device for measuring the magnitude of the torque during movement, and for deducing, from the magnitude of the torque measured, the weight of the fodder and/or drink, present in the feed unit. The magnitude of the torque generated by the movement of the feed unit depends on the amount of fodder and/or drink, in

the feed unit. Also in this situation, the exact correlation between torque and amount of fodder ~~or both~~ in the feed unit can previously be determined by means of simple calibration tests.

A compact feed metering device is obtained when the motor for moving the feed unit and the device for measuring the magnitude of the torque during movement and for deducing, from the magnitude of the torque measured, the weight of the fodder ~~or both~~, present in the feed unit, are integrated ~~in~~ with the animal identification device.

A mechanically simple but accurate construction is obtained when the motor for moving the feed unit drives a torque roll, said torque roll being in contact with the feed unit.

According to the invention, the means for deterring an unwanted animal and the means for measuring the amount of fodder ~~or both~~ in the feed unit can be combined in one means, in that the roll for driving the feed unit as a closing means and ~~the~~ the torque roll used for measuring the torque are constituted by one roll.

In order to be able accurately to perform animal identification and to obtain at the same time a compact construction, a feed metering unit according to the present invention is characterized in that the animal identification device is disposed ~~in a location~~ in the vicinity below the entrance opening, ~~including the~~ ~~brief~~ ~~description~~ of the drawings

The invention will be explained hereinafter in further detail with reference, by way of example, to the drawing in which:

*give elevation view of a*

Figure 1 is a first embodiment of a feed metering device according to the invention;

Figure 2 is a second embodiment of a feed metering device according to the invention;

Figure 3 is a third embodiment of a feed metering device according to the invention;

Figure 4 is a fourth embodiment of a feed metering device according to the invention;

Figure 5 is a fifth embodiment of a feed metering device according to the invention.

## DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

Figure 1 shows schematically a first embodiment of a feed metering device 1 according to the invention. The feed metering device 1 distributes fodder and/or drink, <sup>or both, which for the sake of simplicity</sup> hereinafter to be denoted by feed, <sup>as</sup> by which is meant fodder and/or drink, <sup>or both,</sup> in metered portions to an animal, and is provided with a feed unit 10, also called manger or feeding trough, for containing feed. An entrance opening 11 makes ~~the~~ feed unit 10 accessible to an animal, for example but not exclusively, a cow. An animal identification device 12, known per se, recognizes a particular animal that approaches the feed unit 10 and wishes to use it. The animal identification device 12 is preferably disposed in ~~the~~ feed metering device 1, but may alternatively also be disposed at a distance therefrom. A feed supplying device 13 supplies an amount of feed to the feed unit 10, possibly with the aid of data from the animal identification device 12, ~~the~~ feed <sup>from</sup> a non-shown feed stock entering the feed unit 10 via ~~etc.~~ a non-shown valve <sup>provided for such purpose</sup> and a chute 14.

Thus it is possible for ~~the~~ feed metering device 1 to recognize a particular cow, <sup>and</sup> by means of a transponder fitted to or on the cow. The feed supplying device 13 is controlled in a manner, <sup>well</sup> known ~~per se~~ by software that ensures that the right amount of feed is distributed to the relevant cow.

The feed metering device 1 according to the embodiment of Figure 1 <sup>may be</sup> provided with a non-shown closing means, <sup>such as</sup> closing means will be illustrated in Figure 2. The feed metering device 1 may additionally be provided, on a closing means, with deterring means <sup>or</sup> <sup>both</sup> 15, 16 for deterring an animal that visits the feed unit at an undesired point of time and ~~actually~~ wishes to use it. The deterring means are preferably controlled with the aid of data from the animal identification device. This provides an <sup>additional</sup> manner to deter animals that are not eligible for being fed, in a simple, efficient and <sup>more</sup> <sup>cheap</sup> way, from putting their heads into the feed unit.

In the embodiment shown in Figure 1, the ~~other~~ deterring means includes a loudspeaker 16 for producing an

animal-frightening sound. Alternatively or additionally, the further deterring means may include a lighting device 15 for emitting an animal-frightening light. In particular when a plurality of feed metering devices are disposed side by side, the use of frightening light may be desirable, as this light can be directed in such a manner ~~so~~<sup>as much</sup> that its effect is limited to one particular feed metering device.

Figure 2 shows schematically an embodiment of a feed metering device 2 according to the invention. In this embodiment the closing means 25 is constituted by a separate vessel-like element which is capable of rotating about an axis 26 and is movable across ~~the~~ entrance opening 21. When ~~the~~ closing means 25 is moved across ~~the~~ entrance opening 21, the contents of the feed unit 20 can be made inaccessible to a particular animal.

Additionally, there may be provided further deterring means in the form of a voltage emitting device 27 for emitting an animal-frightening electric voltage to ~~the~~ closing means 25. Animals that undesirably approach the feed metering device 2 often ~~make~~ contact with ~~the~~ feed metering device 2. In particular they will touch ~~the~~ closing means 25 with their noses. By linking with ~~the~~ voltage emitting device 27 ~~properly~~ those components of the feed metering device that are ~~regularly~~ touched by the animals, it is possible to deter a particular animal ~~very~~<sup>locally</sup> as an additional measure. This second embodiment of a feed metering device 2 according to the invention also comprises a feed supplying device 23 and a chute 24 for the feed.

Figure 3 shows schematically a third embodiment of a feed metering device 3 according to the invention. In this embodiment the closing means is constituted by the feed unit 30 itself, which is designed as a movable ~~one~~. In the embodiment shown ~~the~~ feed unit 30 is rotatably disposed about an axis 36. In order to prevent ~~that~~, in the position in which the feed unit 30 closes the entrance opening 31, feed falls from ~~the~~ feed unit 30, ~~the~~ feed unit 30 comprises a wall portion 35 for catching remaining feed. Said wall portion 35 can also act as a feed

guide means for feed that is supplied to ~~the~~ feed unit 30 via the chute 34 of ~~the~~ feed supplying device 33.

For the purpose of providing, besides a simple, but reliable construction, also a compact construction, according to the invention a roll 29 respectively 39 ~~or 19~~ is driven by a motor 28 respectively 38, which will ~~to~~ 29 & 39, contacts the closing means 25 respectively 30. Preferably the feed unit 30 thus bears on the animal identification device 32 via the roll 39. Roll 19 is also preferably driven by a motor such as motor 28 or motor 38.

An extremely compact construction is obtained when ~~the~~ motor 28, 38 and the roll 29, 39, are included in a housing B, C respectively, which is disposed in the vicinity below the entrance opening. Preferably the housing also contains the relevant animal identification devices 22 or 32, respectively.

According to the invention, the feed metering device may be provided with means for weighing the feed present in the feed unit, which means moves the feed unit in a pivoting, respectively a rotating manner. With the aid of said means it is possible to determine how much feed is consumed by a particular animal, and at the same time whether remaining feed is present in the feed unit. The means for weighing the feed present in the feed unit ~~is~~ preferably connected to the feed supplying device for supplying an amount of feed to the feed unit with the aid of data both from the animal identification device and the weighing means, so that the amount of feed left by the previous animal can be taken into account.

In the embodiment of Figure 1, the means for weighing the feed present in the feed unit 10 comprises a feed unit 10 which is pivotable about a hinge pin 17. The degree of pivotability is determined by the weight of the feed present in the feed unit 10. There is provided a device 18 for determining the degree of pivotability of the feed unit 10 and for deducing therefrom the weight of the feed present in the feed unit 10. The device 18 for determining the degree of pivotability of the feed unit 10 comprises a measuring roll 19 which is in contact with the feed unit. From the degree of rotation of the roll 19

the degree of pivotability and thus the amount of feed in ~~the~~<sup>and roll</sup> feed unit 10 can be determined.

Due to the fact that ~~the~~ device 18, 19 for determining the degree of pivotability of the feed unit 10 ~~are~~<sup>and roll</sup> integrated in the housing A, in ~~which~~<sup>the</sup> the animal identification device 12 may be disposed as well, a compact construction of the feed metering device is obtained. Alternatively, ~~the~~ the device 18, 19 <sup>and roll</sup> may be located outside ~~the~~ housing A.

As shown in the embodiment of Figure 2, ~~the~~ device 201 for determining the degree of pivotability of ~~the~~ feed unit 20 and for deducing therefrom the weight of the feed present in ~~the~~ feed unit 20 may alternatively or additionally comprise a load sensor 202. In the embodiment shown ~~the~~ feed unit 20 bears on ~~the~~ load sensor 202 via a supporting arm 203, while the feed unit 20 pivots about a hinge pin 204. ~~The~~ Load sensor 202 is preferably included in ~~the~~ housing B.

In the embodiments shown in figures 1 and 2, even small differences in weight can be measured due to the fact that the hinge pins 17, 204 and ~~the~~ measuring roll 19, respectively ~~the~~ load sensor 202, are located at small distances from each other.

In order to prevent the measuring roll, the load sensor or similar from being damaged in case of an undesired defect, e.g. when, ~~for example~~, the animal pushes the manger downwards with force, there may be provided in both embodiments a safety supporting bracket 101 (Figure 1) ~~or~~ respectively 205 (Figure 2), for supporting ~~the~~ feed units 10, 20, respectively.

In the embodiment of Figure 3, the means for weighing the feed present in the feed unit comprises a movable feed unit 30. ~~The~~ Feed unit 30 is moved in a reciprocating manner by ~~the~~ motor 38 by which ~~the~~ roll 39 is driven. As a result of this movement there occurs a torque whose magnitude is determined by a device 301 for measuring ~~the~~ magnitude of the torque. The device 301 deduces the weight of the feed present in the feed unit from ~~the~~ torque <sup>as so</sup> determined. The exact correlation between torque and amount of feed can previously be determined by ~~means~~ simple calibration tests.

The embodiment according to Figure 3 has a compact construction due to the fact that ~~the~~ motor 30 for moving ~~the~~ feed unit 30 and ~~the~~ device 301 for measuring ~~the~~ magnitude of the torque during movement and for deducing, from the magnitude of the torque measured, the weight of the feed present in the feed unit 30, are integrated in ~~the~~ housing C.

Although ~~in addition to~~ roll 39, there may be used a separate torque roll, ~~the~~ roll 39 preferably functions as a drive of the closing means, in this situation constituted by ~~the~~ feed unit 30 itself, as well as ~~functioning as~~ <sup>and as</sup> ~~respectively~~ a measuring roll. Of course the torque can also be measured via ~~the~~ motor.

The fourth embodiment of a feed metering device 4 according to the present embodiment, as shown in Figure 4, comprises means for deterring an animal ~~from~~ <sup>to</sup> ~~use~~ ~~the~~ feed unit 40, with the aid of data from ~~the~~ animal identification device 42, as well as means for weighing the feed present in ~~the~~ feed unit 40.

The closing means 46, which is rotatable about an axis ~~la~~ 45, is set in rotation by a roll 47 which can come into contact with the closing means 46. The roll 47 is driven by a motor 48 which is controlled with the aid of data from ~~the~~ animal identification device 42.

In this embodiment, the weighing means ~~are constituted~~ <sup>consistutes</sup> by ~~the~~ feed unit 40 which is rotatable about an axis 49. The feed unit 40 can be brought into contact with ~~the~~ roll 47, and is subjected to a reciprocating motion by correctly controlling ~~the~~ motor 48 that drives ~~the~~ roll 47. By the movement of ~~the~~ feed unit 40 <sup>a torque</sup> there is generated a torque that can be measured by ~~the~~ torque measuring device 401.

In the situation shown in Figure 4, ~~the~~ roll 47 makes contact with ~~the~~ feed unit 40 <sup>when</sup> ~~the~~ latter ~~is~~ can be set in motion for determining the amount of feed present in ~~the~~ feed unit 40. After an animal has consumed ~~the~~ feed, the amount of remaining feed, can be determined by torque measurement. Then ~~the~~ roll 47 is controlled by ~~the~~ motor 48 in such a manner that ~~the~~ feed unit 40 will be partially located <sup>so</sup> ~~in~~ the entrance opening 41. A catching element 402 on ~~the~~ feed unit 40 takes the closing

means 46 along until the latter comes into contact with the roll 47. The roll 47 then controls the closing means 46 in such a manner that the latter covers the entire entrance opening 41. As a result of the fact that the feed unit 40 is no longer in contact with the roll 47, the feed unit 40 falls back to the starting position in which feed can, possibly be added by the feed supplying device 43 via the chute 44.

The fifth embodiment of a feed metering device according to the present invention, as shown in Figure 5, differs from that of Figure 4 by the position of the hinge pin 59 about which the feed unit 50 rotates. The hinge pin 59 is positioned close to the roll 56 for driving the feed unit 50 and measuring the torque, for measuring very small differences in the amount of feed. There is also provided a stop 58 for preventing superfluous movement of the feed unit 50. The closing means 55 for closing the entrance opening 51 pivots about the axis 57.

For the purpose of being able accurately to perform animal identification and to obtain at the same time a compact construction, a feed metering device according to the present invention is characterized in that the animal identification device is disposed in the housing E which is located in the vicinity below the entrance opening. Although the invention has been described on the basis of an animal identification device, which may be, possibly provided with weighing means or body deterring means, which is fitted to the so-called stationary world, it is also possible to dispose the animal identification device and/or the weighing and/or deterring means on the a possibly movable feed unit.

Although I have disclosed the preferred embodiments of my invention, it is to be understood that it is capable of other adaptations and modifications within the scope of the following claims.